A SPIRAL RESONATOR FOR AN ELECTRON PARAMAGNETIC RESONANCE SPECTROMETER WITH HIGH FREQUENCY MODULATION OF THE MAGNETIC FIELD

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E.P.R. SPECTROMETERS with high frequency modulation of the magnetic field are widely used nowadays[1–5] and achieve high sensitivity with a relatively simple circuit. Three methods are used to introduce the high frequency modulation: (1) slotted resonators;[1–3] (2) glass or plastic resonators with a thin silver covering which is thinner than the skin depth at the modulation frequency;[4] (3) by introducing a special modulation loop into the resonator.[4,5]

All these types of resonators are designed mainly for studying substances with isotropic spectra and are inconvenient for studying anisotropic spectra in single crystals.

The following demands are made of the resonator of an e.p.r. spectrometer with high frequency field modulation, designed for studying anisotropic spectra: (1) high Q; (2) a tuning range for the resonator not less than that of the klystron used ($\sim$ 15 per cent); (3) uniformity of the high frequency modulated field over a large volume; (4) the possibility of rotating the magnet round a vertical axis; (5) the absence of unwanted modes of oscillation; and (6) the possibility of cooling the specimen being studied.

Requirements (2) and (3) cannot be met in resonators of the first type. Resonators of the second type are complicated to construct and fragile, so that it is difficult to satisfy requirements (1), (2), (4), and (5) with them. Resonators of the third type usually work with fixed tuning.

The best satisfaction of all the requirements of a resonator is achieved with a cylindrical resonator oscillating in the H_{011} mode, with side walls which are a section of a spiral waveguide[6] (Figure 1). The body of the resonator is the spiral 1 made from copper enamelled waveguide PEL–0·1 wound coil-to-coil and cemented in the plastic mounting 2. The inner surface of the spiral is protected by the 0·2 mm thick film 3. On top is placed the plastic ring 4 with the guide screw 5, closed by the non-contacting piston 6. The ring is fixed to the resonator by washer 7. The input and output waveguides 8 are joined to the bottom of the resonator 9. The coupling orifices 10 are of 6·5 mm diameter. The specimen under investigation is placed in the resonator from above on a special holder which makes it possible to rotate the specimen relative to two mutually perpendicular horizontal axes, so that the specimen can be orientated accurately in the magnetic field.

With the construction described, the resonator wall completely suppresses all unwanted modes of oscillation. Measurements carried out showed that the resonator walls are completely transparent to high frequency oscillations with magnetic component perpendicular to the resonator axis. The high frequency modulating magnetic field is produced by external coils, the number of windings depending on the modulation frequency chosen (frequencies of 110 kc/s and 1 Mc/s

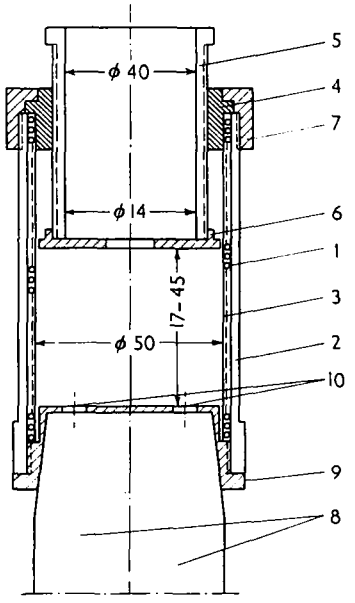

Figure 1. Resonator

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